

This Page Is Inserted by IFW Operations  
and is not a part of the Official Record

## **BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning documents *will not* correct images,  
please do not report the images to the  
Image Problem Mailbox.**

(12) **UK Patent Application** (19) **GB** (11) **2 242 527 A** (13)  
 (43) Date of A publication 02.10.1991

(21) Application No 9006873.5

(22) Date of filing 28.03.1990

(71) Applicant  
**GEC-Marconi Limited**

(Incorporated in the United Kingdom)

The Grove, Warren Lane, Stanmore, Middlesex  
 HA7 4LY, United Kingdom

(72) Inventor  
**John Albert Pye**

(74) Agent and/or Address for Service  
**Marlin Hyden**  
**GEC Patent Department, GEC-Marconi Research**  
**Centre, West Hanningfield Road, Great Baddow,**  
**Chelmsford, Essex, CM2 8HN, United Kingdom**

(51) INT CL<sup>4</sup>  
**G01C 22/02**

(52) UK CL (Edition K)  
**G1N NAEA NAHJ N1A6 N1B3 N1D7 N4E N4F2**  
**N7N**  
**U1S S1820 S1831 S1844 S2145**

(56) Documents cited  
**US 4697278 A**

(58) Field of search  
**UK CL (Edition K) G1N NAHJ**  
**INT CL<sup>4</sup> G01C 22/00 22/02**

(54) **A revolution counting system**

(57) A revolution counting system comprises a counter unit 1 fixed to a hub of a trailer wheel and a reader unit 14. The counter unit 1 has an electronic memory which stores the distance travelled by the trailer. Upon interrogation, the distance travelled is transmitted to the reader unit 14 where it is displayed on display 15 which, because it is part of the reader unit 14, is less susceptible to obscuration by dirt than would be the case if it were mounted on the counter unit. The transmission may be by radio using a transponder in the counter unit 1, responding to an initiating signal from the reader unit 14. The transmitted information may include data identifying the counter unit, the reader being capable of reading and storing data relating to many counters for subsequent transmission to a vehicle fleet monitoring computer. The reader unit may be hand-held, as shown, or fixed in a vehicle depot or rail wagon yard.

A counter unit is described having a backplate 5 which rotates with the wheel and carries a disc 9 with the electronic circuitry and power and signal generating coils. The coils pass through the field of a magnet 8 on an arm 7 which hangs freely in a bearing 6.

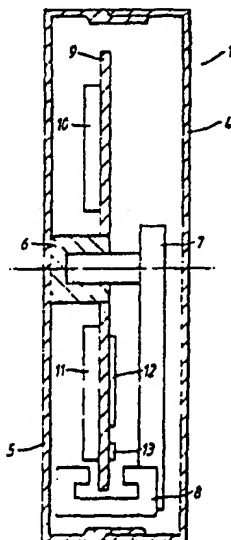


Fig. 2.

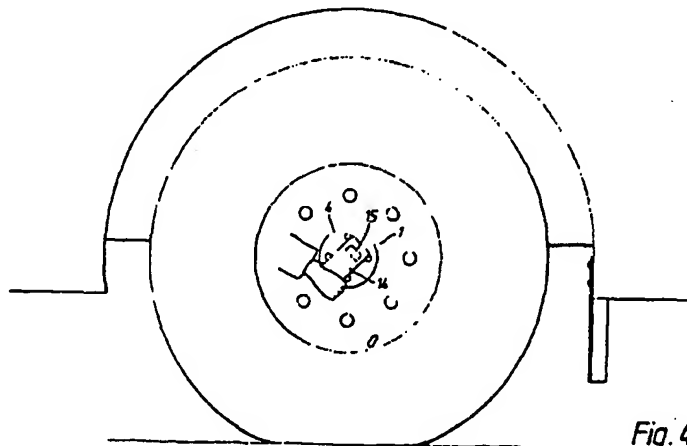


Fig. 4.

1/4

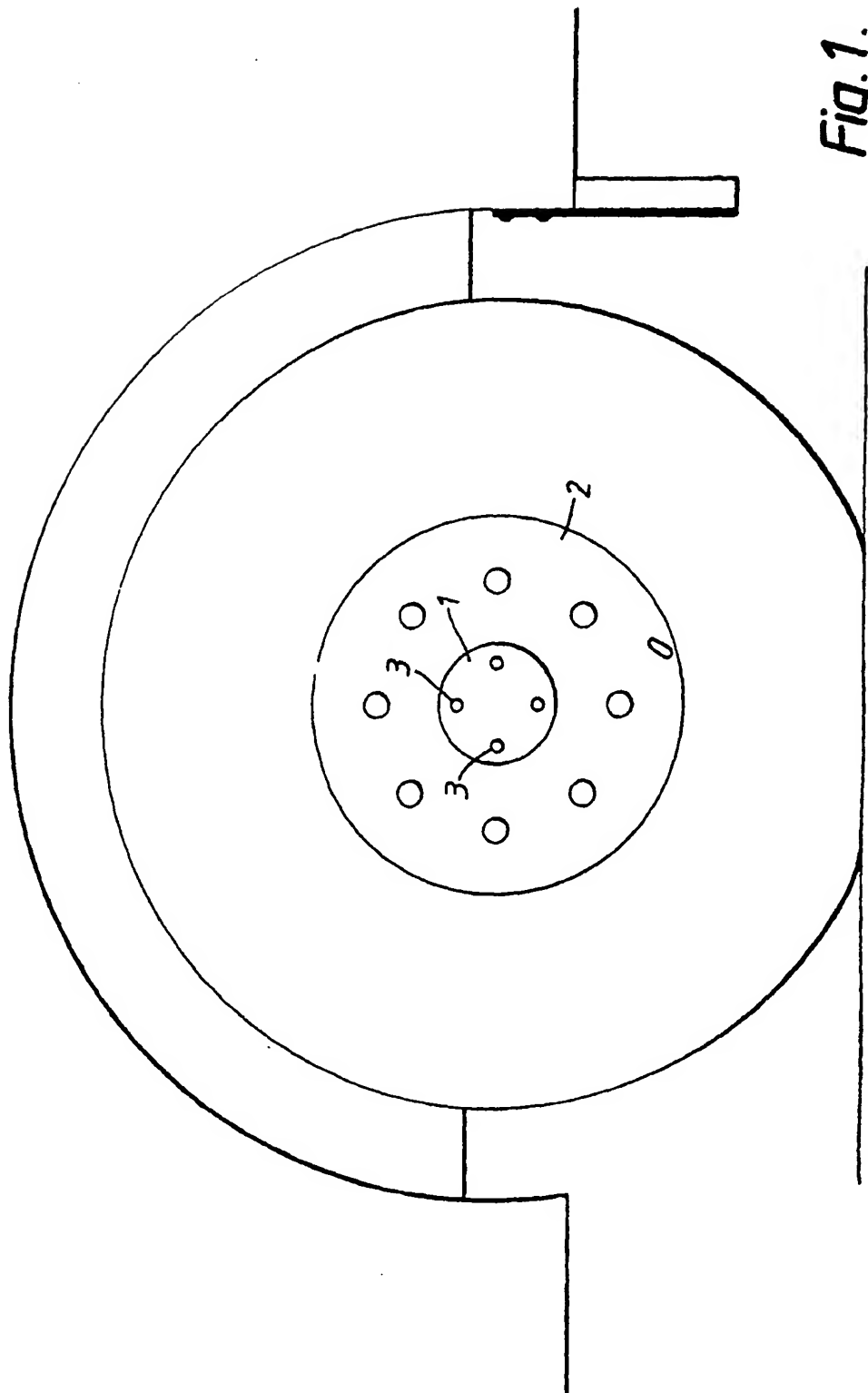


Fig. 1.

2/4

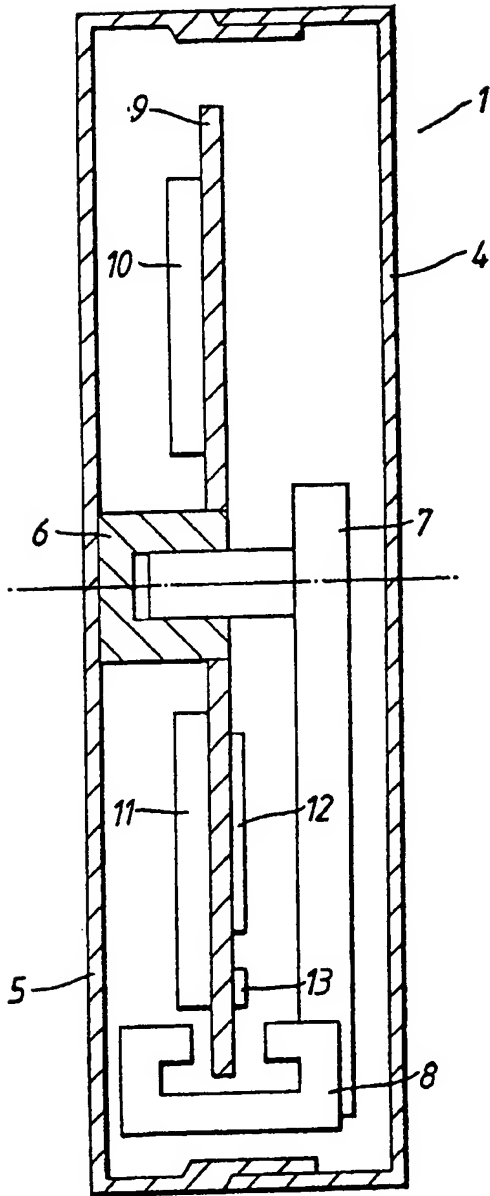


Fig. 2.

3/4

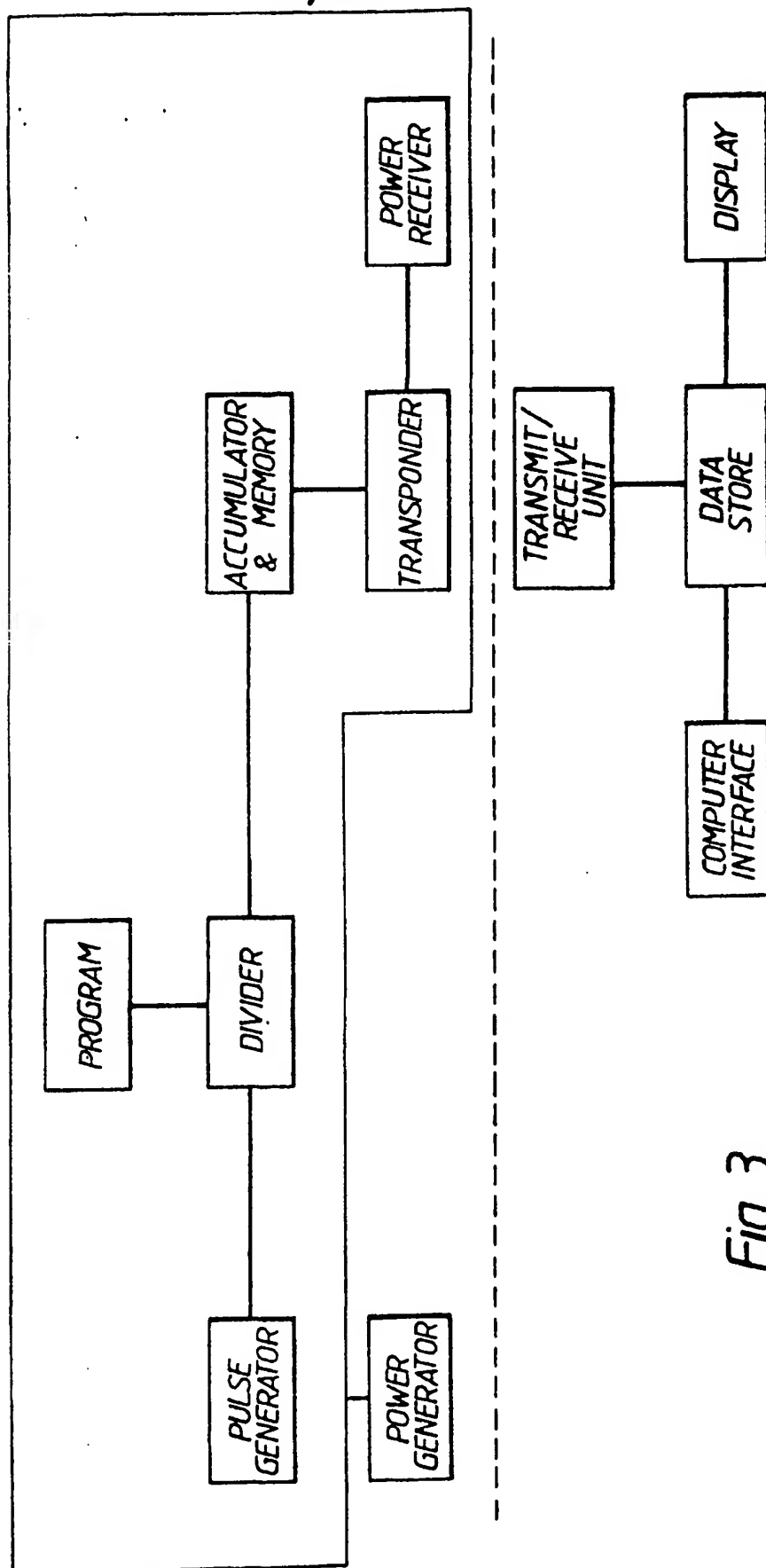


Fig. 3.

4/4

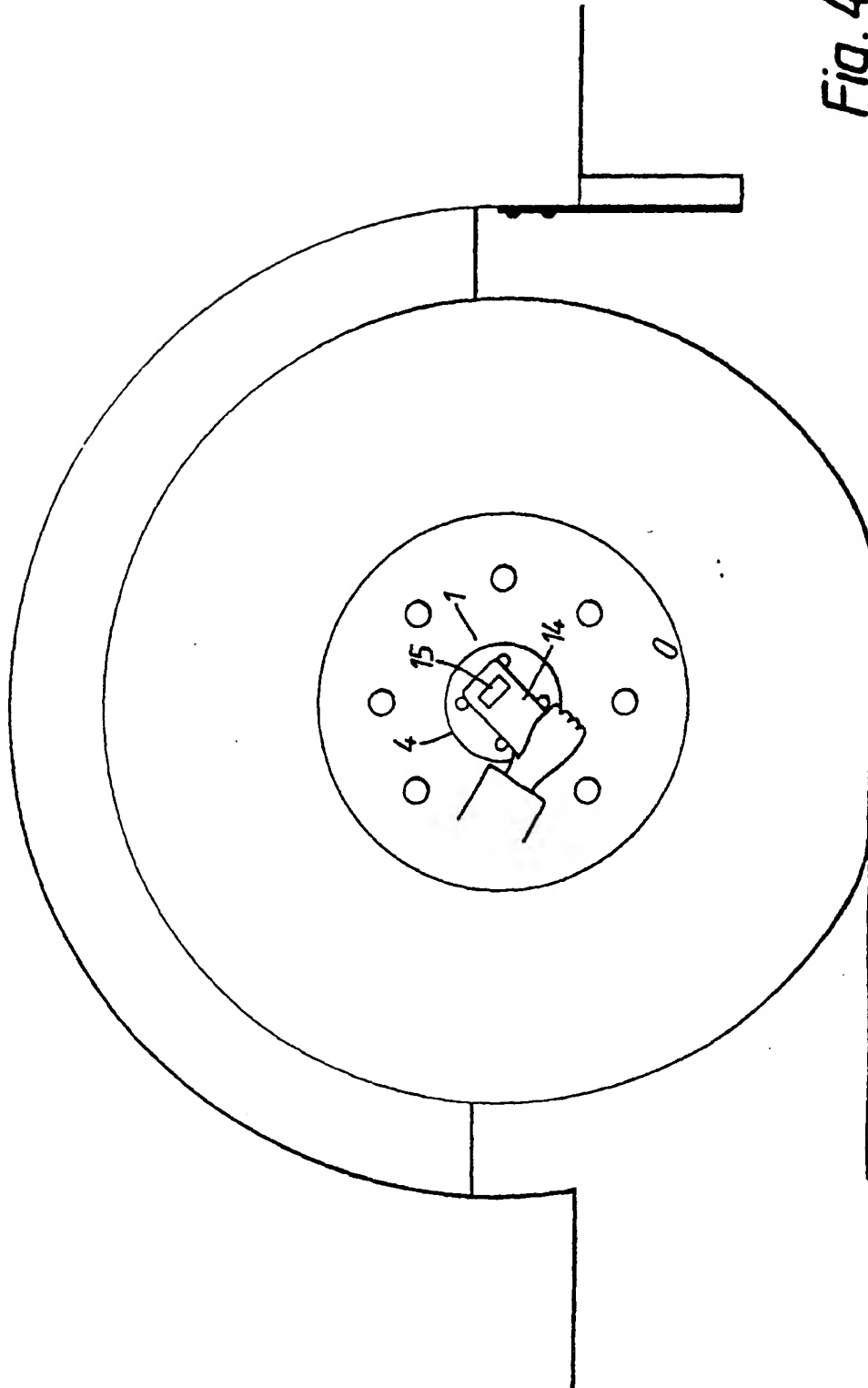


Fig. 4.

- 1 -

A Revolution Counting System

This invention relates to a revolution counting system particularly but not exclusively for use on road and rail vehicle wheels.

It has been previously proposed to provide revolution counters for mounting on the hubs of wheeled vehicles such as lorries or trailers for recording distance travelled. Such counters or "odometers" are mechanical units which use the wheel's motion to drive a drum counter. Being mechanical units they can be unreliable and the drum counter reading must be observed visually by an operator and subsequently recorded. Mistakes may occur in reading the counter for, being fitted to a road wheel, it will be liable to be obscured by dirt. Such odometers also suffer from an additional drawback which is that they have to be large enough to house the required mechanical linkages. This means that in certain circumstances they protrude far enough from the wheel hub to be susceptible to damage.

According to the invention there is provided a revolution counter unit for mounting on a rotating body comprising means for producing a signal in response to

- 2 -

rotation of the body which is repeated for every rotation, part or multiple of rotation thereof; a memory for storing signal data; and means for communicating to a reader unit the signal data to a device separate from said body.

By incorporating a memory for storing signal data produced by the body's rotation and means for communicating the data to a reader unit, the unit may be more compact and because, the requirement for having a display on the wheel will have been eliminated, the unit will also be more rugged.

A more compact unit means that the the unit is less likely to be damaged by collisions and by eliminating the display from the wheel hub reduces the likelihood of transcription errors.

While the rotating body may be a wheel hub, the invention is also applicable to rotating shafts or other rotating bodies.

Conveniently, there is provided means for accumulating the signals to produce the signal data to be stored.

Preferably, power generation means are included to



- 3 -

generate power from the rotation of the body.

This also allows a rechargeable battery to be used to power the counter unit being recharged by rotation of the counter unit. Such a generator may, of course, eliminate the requirement for a battery completely although some power storage means may be required if the power generation is low due to slow rotation of the body.

Conveniently, the means for producing a signal comprises a magnet and coil. The magnet may be placed on a arm freely pivotable about the axis of the hub and the coil fixed to the hub such that the arm maintains its position whilst the coil passes it once per revolution. A current will then be induced according to Lenz's Law which will be the signal to be counted. Of course the position of the coil and magnet may in some applications be exchanged.

Preferably, the power generation means comprises a magnet and coil. It is envisaged that an arrangement as described above for the signal producing means could be similarly used to generate the power required by the unit although the coil used would have to be appropriate to the required power and more than one coil might be required.

- 4 -

Advantageously, the power generator means and the means for producing a signal comprise at least one power generating coil, a signal coil and a magnet.

This would be advantageous because the same magnet could be used for both generating the signal and the power.

Alternatively, the same coil may be used both to generate the signal and the power. It is envisaged that such a system would require more complicated circuitry in order to isolate the signal from the power.

According to a second aspect of the invention there is provided a revolution reader unit comprising means for receiving data from a revolution counter unit as described above; memory for storing data communicated thereto by the counter unit.

Preferably, the reader unit includes display means for displaying the stored data.

The display means may comprise a display such as a liquid crystal display, a led display, a vacuum tube or a printer producing a paper copy of the recorded data.

---

- 5 -

Preferably, means are provided for communicating data stored in said memory to further data processing means.

This is preferable, for the further data processing means might be a computer suitably programmed to process the data to, for instance predict, when maintenance is required, future maintenance requirements and maintenance costs for a whole fleet of vehicles equipped with the counters. The means for communicating the data stored in said memory might be a RS 232 interface or by a contactless interface.

According to a further aspect of the invention there is provided a revolution counting system comprising a revolution counting unit and a revolution counting reader unit as previously described.

In the system, the reader unit and counter unit might communicate with each other in any suitable manner. Furthermore, the data transmitted to the reader can include data identifying the counter unit in question.

Preferably, the counter unit communicates with the reader unit in a contactless manner. This avoids electrical contacts which can be impaired by dirt grease or other contamination. Contactless communication links could

- 6 -

include opto electronic links, inductive links, radio wave link or microwave links. It is particularly preferred that the counter communicates with the reader unit via a radio frequency link.

Power can conveniently be transmitted to the counter unit from the reader unit and is at least partly used to transmit the data to the reader. This can reduce the battery capacity required and will be essential if no battery is present.

Advantageously, the counter unit is mounted on a hub of at least one wheel of a vehicle and the reader unit is fixed in a position such that when said one wheel passes in the proximity of said reader, the counter unit and reader can communicate.

This is advantageous because the requirement for a human operator to take the readings is eliminated as they might be automatically taken as, for instance, the vehicle passed through an entrance to a depot.

A specific embodiment of the invention will now be described, by way of example only, with reference to the drawings in which:

- 7 -

Figure 1 shows an odometer in accordance with one embodiment of the invention fitted to a wheel hub;

Figure 2 shows a section through the odometer of Figure 1;

Figure 3 shows a block diagram of the odometer circuitry and a reader unit circuitry in accordance with an embodiment of the invention; and

Figure 4 shows a reading being taken.

With reference to Figure 1, a revolution counter unit 1 is connected to a wheel 2 by bolts 3. The revolution counter unit 1, shown in greater detail in Figure 2, comprises a coverplate 4 and a backplate 5 which together define a protective case for the internal components. A bearing 6 is fixed to the backplate 5 at the axis of rotation, into which a shaft 7 is journalled. A permanent magnet 8 is fixed to one end of an arm attached to the shaft 7 and a disc 9, which carries electronic components 10 and 11 as well as a UHF aerial 12 and a LF coil 13 is fixed to the bearing 6. A power generating coil and a signal coil (not shown) are also mounted on the disc 9.

- 8 -

When the wheel 2 rotates, the counter unit 1 also rotates. The magnet 8 remains in the lowermost position as shown because the shaft 7 is freely rotatable in the bearing 6. The disc 9, with associated electronics and coils therefore rotate with the wheel and thus the coils pass between the poles of the magnet. Currents are therefore induced in the coils, the power coil producing the power for the electronics and the signal coil producing a signal in the form of a current pulse every revolution. Hence the magnet and signal coil constitute a pulse generator.

The pulse generator is connected to the electronic circuitry as shown schematically in Figure 3. The circuit which could be a microprocessor is programmed to divide the number of pulses in order to obtain the distance travelled. The circuit can be programmed with data appropriate to the various sizes of wheels which may be fitted. For example, a 1 metre diameter roadwheel would have a circumference of approximately 3 metres which would mean that about 333 pulses would be produced per Kilometer. Therefore the number of pulses would be divided by 333, that is, for every 333 pulses 1 would be added to an accumulator and stored in a memory.

- 9 -

In order to read the accumulated distance from the revolution counter unit 1 a hand held reader unit 14 is positioned in the vicinity of the cover plate 4 as shown in Figure 4 and the accumulated reading displayed on liquid crystal display 15.

This is achieved by the circuitry in the following manner. The counter unit 1 has a transponder and power receiver as shown in Figure 3. These are the HF aerial 12 and LF aerial 13 respectively. With the reader unit 14 positioned in the vicinity of the counter a switch is depressed by the operator which activates a transmit receive unit. The low frequency aerial 13 receives energy from this unit which is then used to power a h.f. transmitter connected to the HF aerial 12. Communication between the units is then possible and the unit identity and the number held by the accumulator is transmitted to the reader unit where it is stored in a data store and displayed.